disadvantage

[3] Require very large area To be Constructed //

10/5/2017 lec د. عمرو

Parabolic reflector Antenna

APPLICATIONS:

are The Most Commonly used antennas for

[1] Radar
[2] Micro Wave links
[3] satellite earth stations
[4] satellite home T.V receivers

why ???

Because iT provided very high gain and directivity

why ???

Types of reflector antennas:

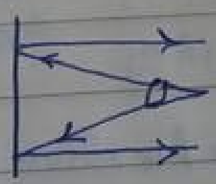
Can be classified according To

(1) reflecting surface

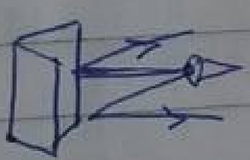
(2) feeding

reflecting surface

(1) Plane reflector



[2] Corner reflector

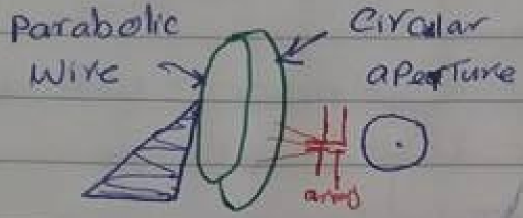


feeding

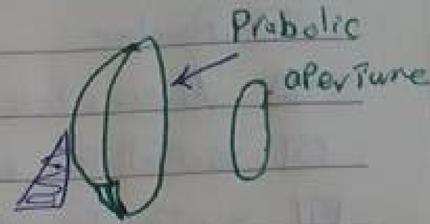
(1) dipole feed
[2] array of dipole feed
(3) Horn antenna feed
[4] → front feed
→ cassegrain feed

3 Curved reflector

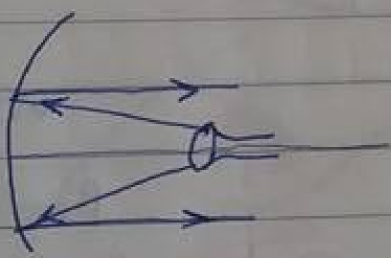
Single curved prabolic antenna



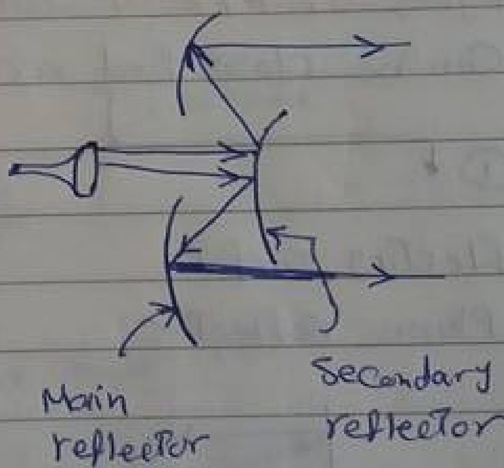
double curved Parabolied antenna



1 front feed



2 Cassegrain feed



إيهما أقوى

Cassegrain

as IT increase The reflection area give higher gain

* Parameters of Parabolic reflector antenna.

(F, d, θ_o)

$F \Rightarrow$ focal length

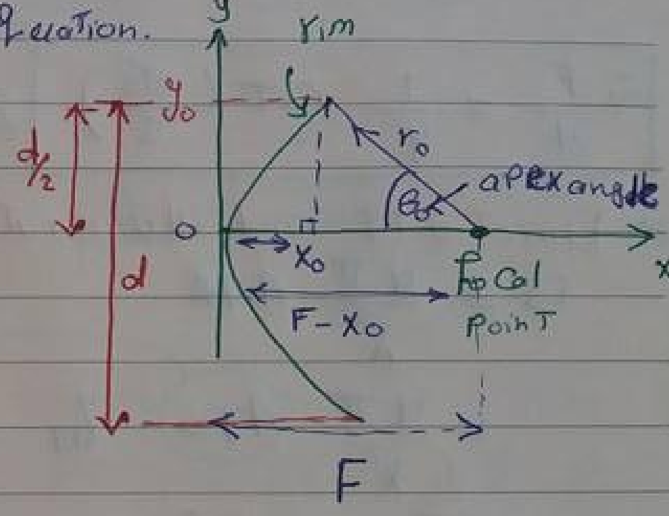
$d \rightarrow$ aperture diameter

$\theta_o \rightarrow$ apex angle

Drive an expression that relates them together.

$$\boxed{\frac{F}{d} = \frac{1}{4} \cot\left(\frac{\theta_o}{2}\right)}$$

Starting from parabolic equation.



$$y^2 = 4Fx$$

$$y_o^2 = 4FX_o$$

$$X_o = \frac{y_o^2}{4F}$$

$$\boxed{X_o = \frac{(d/2)^2}{4F}} \rightarrow ①$$

تم الربط بين F,d عايزين θ_o

نجيبها من الرسم للحصول على θ_o

$$\tan\theta_o = \frac{d/2}{F - X_o}$$

نعوض عن ① من

$$\tan\theta_o = \frac{(d/2)}{F - \frac{(d/2)^2}{4F}} = \frac{(d/2F)}{1 - \frac{(d/2)^2}{4F^2}}$$

$$\tan\theta_o = \frac{d/2F}{1 - \left(\frac{d/2}{2F}\right)^2} = \boxed{\frac{2\left(\frac{d/2}{2F}\right)}{1 - \left(\frac{d/2}{2F}\right)^2}}$$

بالمقارنة

$$\boxed{\tan 2\alpha = \frac{2\tan\alpha}{1 - \tan^2\alpha}}$$

* $\theta_0 = 2\alpha$

$$\boxed{\alpha = \frac{\theta_0}{2}} \quad , \quad \tan\alpha = \left(\frac{d/2}{2F}\right)$$

$$\tan\frac{\theta_0}{2} = \frac{d/2}{2F} = \frac{d}{4F}$$

$$\frac{F}{d} = \frac{1}{4} \cdot \frac{1}{\tan\left(\frac{\theta_0}{2}\right)}$$

apex angle

$$\boxed{\therefore \frac{F}{d} = \frac{1}{4} \cot\left(\frac{\theta_0}{2}\right)} \quad \#$$

ف الامعا :

* Directivity and illumination efficiency

$$D = \frac{4\pi}{\lambda^2} A_{eff}$$

مساحة الدائرة

$$= \frac{4\pi}{\lambda^2} A_{geo} \cdot \eta_{ill}$$

$$= \frac{4\pi}{\lambda^2} \cdot \pi\left(\frac{d}{2}\right)^2 \cdot \eta_{ill}$$

$$= \frac{4\pi^2}{\lambda^2} \cdot \frac{d^2}{4} \cdot \eta_{ill}$$

وتتوقف على اربع حاجات

$$\boxed{D = \left(\frac{\pi d}{\lambda}\right)^2 \cdot \eta_{ill}}$$

① depends on the gain function of the feeder

describe

② θ_0

③ d

④ F

$$\eta_{ill} = \cot^2\left(\frac{\theta_0}{2}\right) \left| \int_{\theta=0}^{\theta_0} \tan\left(\frac{\theta}{2}\right) \sqrt{G_F(\theta')}\, d\theta' \right|^2$$

للتوضيح فقط حفظها كلها مش هتحل بيه

$G_f(\theta') \Rightarrow$ is The gain function of The feeder

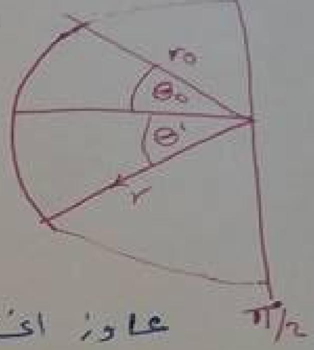
$$\boxed{* \; G_f(\theta') = \begin{cases} G_o(n) \cos^n(\theta') & 0 < \theta' < \frac{\pi}{2} \\ 0 & \frac{\pi}{2} < \theta' < \pi \end{cases}}$$

ليه اختار θ' من $0 : \frac{\pi}{2}$

عشان بعد ال Parabola كلها زوايات سبتا بحصل فى back pattern مختلف

اشرح ازاى اختار ال feeder بتاع اللازم

يحقق ال gain function



$$\boxed{G_o(n) = 2(n+1)}$$

عاوز اختار ال Parabola من Antenna من

$\underline{2 = n}$ يعنى second order

$G_o(2) = \cos^2\theta \cdot (6)$

لازم اعرف ال η_{ill}

① احدد ال order و θ_0

$n = 8$

$\theta_0 = 30^\circ$

افضل η_{ill} لل θ_0 تصبح د 70°

لو $\theta_0 = 60$ اطلع على curve واشوف η_{ill}